

Amendments to the Claims:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Original) An endpoint device for use in a communication system wherein the endpoint device which has received an interrogating signal containing a main carrier and transmitted from an interrogator responds to the interrogator with a reflected signal which is generated by modulating the main carrier with appropriate information, said endpoint device comprising:

a distance detecting portion operable to detect a distance between said interrogator and said endpoint device;

a reflecting portion operable to receive and reflect said interrogating signal transmitted from said interrogator;

an information generating portion operable to generate replying information to be transmitted to said interrogator;

a band determining portion operable to determine, on the basis of said distance detected by said distance detecting portion, a frequency band of a modulating signal used to modulate a reflected signal generated by said reflecting portion; and

a modulating-signal generating portion operable, according to said replying information generated by said information generating portion, to generate said modulating signal having a frequency within said frequency band determined by said band determining portion.

2. (Previously Presented) The endpoint device according to claim 1, wherein said band determining portion is operable to determine said frequency band so that a center frequency of the determined frequency band increases with a decrease in said distance detected by said distance detecting portion.

3. (Original) The endpoint device according to claim 1, wherein said band determining portion is operable to determine said frequency band on the basis of said distance detected by said distance detecting portion, and according to a predetermined equation representative of a relationship between said distance and frequency band.

4. (Original) The endpoint device according to claim 1, wherein said band determining portion is operable to determine said frequency band on the basis of said distance detected by said distance detecting portion, and according to a predetermined data table representative of a relationship between said distance and said frequency band.

5. (Original) The endpoint device according to claim 1, wherein said band determining portion is operable to determine said frequency band on the basis of said distance detected by said distance detecting portion, and according to a predetermined data table representative of a relationship between a plurality of ranges of said distance and a plurality of frequency bands which respectively correspond to said plurality of ranges of said distance and each of which consists of a group of a plurality of mutually adjacent frequency channels, said band determining portion being operable to select, randomly or according to a predetermined rule, one of said plurality of channels of the group corresponding to one of said plurality of ranges to which the distance detected by said distance detecting portion belongs.

6. (Original) The endpoint device according to claim 1 wherein said modulating-signal generating portion is operable to generate said modulating signal in one of a plurality of time frames which is selected randomly or according to a predetermined rule.

7. (Original) The endpoint device according to claim 1, wherein said modulating-signal generating portion maintains the frequency band determined by said band determining portion, until transmission of said replying information to said interrogator is completed.

8. (Original) The endpoint device according to claim 1, further comprising a charging portion operable to charge the endpoint device with an electric energy derived from said interrogating signal, and wherein said charging portion activating the endpoint device when an amount of said electric energy stored in said endpoint device has reached a predetermined value.

9. (Original) The endpoint device according to claim 8, wherein said distance detecting portion is operable to detect said distance between said interrogator and said endpoint device, on the basis of a change of the electric energy with which the endpoint device is charged by said charging portion.

10. (Original) The endpoint device according to claim 9, further comprising a voltage detecting portion operable to detect a voltage of said charging portion, and wherein said distance detecting device detects the change of said electric energy on the basis of the voltage detected by said voltage detecting portion.

11. (Original) The endpoint device according to claim 1, wherein said distance detecting portion is operable to detect said distance on the basis of an intensity of said interrogating signal.

12. (Previously Presented) A communication system comprising:
an interrogator operable to transmit an interrogating signal containing a main carrier; and
an endpoint device operable to receive the interrogating signal and respond to the interrogator with a reflected signal that is generated by modulating the main carrier with appropriate information;
the interrogator including:

a distance detecting portion operable to detect a distance between said interrogator and said endpoint device on the basis of an intensity of a modulating signal with which said reflected signal has been modulated in said endpoint device, and

a distance-information transmitting portion operable to transmit to said endpoint device distance information indicative of the distance detected by said distance detecting portion; and

the endpoint device including:

(a) a reflecting portion operable to receive said interrogating signal containing said main carrier and transmit said reflected signal to said interrogator,

(b) an information generating portion operable to generate replying information to be transmitted to said interrogator,

(c) a band determining portion operable to determine a frequency band of said modulating signal on the basis of said distance information received from said distance-information transmitting portion, and

(d) a modulating-signal generating portion operable, according to said replying information generated by said information generating portion, to generate said modulating signal having a frequency within said frequency band determined by said band determining portion.

13. (Previously Presented) A communication system comprising:

an interrogator operable to transmit an interrogating signal containing a main carrier; and

at least one endpoint device operable to receive the interrogating signal and respond to the interrogator with a reflected signal that is generated by modulating the main carrier with appropriate information;

the interrogator including:

(a) a communication-condition detecting portion operable to detect a condition of communication of the interrogator with said at least one endpoint device on the basis of at least one of a collision rate among the reflected signals transmitted from a plurality of endpoint devices, the number of occurrences of collision among the reflected signals transmitted from said plurality of endpoint devices per unit time, and an amount of error data contained in said reflected signal transmitted from each endpoint device, the condition of communication being at least able to permit communication between the interrogator and the at least one endpoint device;

(b) an available-band determining portion operable to determine an available frequency band of a subcarrier signal available for said at least one endpoint device on the basis of said condition of communication detected by said communication-condition detecting portion, and

(c) a band-information transmitting portion operable to transmit to each endpoint device band information representative of said available frequency band of said subcarrier signal determined by said available-band determining portion; and

the at least one endpoint device including a frequency determining portion operable to determine a frequency of said subcarrier signal within said available frequency band represented by said band information received from said band-information transmitting portion of said interrogator.

14. (Original) The communication system according to claim 13, wherein said available-band determining portion is operable to change an upper limit of said available frequency band on the basis of said condition of communication detected by said communication-condition detecting portion.

15-17. (Canceled)

18. (Previously Presented) The communication system according to claim 13, wherein said available-band determining portion is operable to determine said available frequency band so that an upper limit of said available frequency band increases with an increase in said at least one of said collision rate, said number of occurrences of collision and said amount of error data, which has been detected by said communication-condition detecting portion.

19. (Canceled)

20. (Previously Presented) The communication system according to claim 13, wherein said available-band determining portion is operable to determine said available frequency band so that an upper limit of said available frequency band is increased when said collision rate, said number of occurrences of collision or said amount of error data which has been detected by said communication-condition detecting portion is equal to or larger than a predetermined first threshold value, and decreased when said collision rate, said number of occurrences of collision or said amount of error data is equal to or smaller than a predetermined second threshold value.

21. (Canceled)

22. (Original) The communication system according to claim 20, wherein said available-band determining means is operable to adjust said first and second threshold values on the basis of said collision rate, said number of occurrences of collision or said amount of error data which has been detected by said communication-condition detecting portion.

23. (Original) The communication system according to claim 13, wherein said available-band determining portion is operable to set an upper limit of said available frequency band at a maximum value in an initial state of the communication system.

24. (Original) The communication system according to claim 13, wherein said available-band determining portion is operable to set an upper limit of said available frequency band at a minimum value in an initial state of the communication system.

25. (Original) The communication system according to claim 13, wherein said frequency determining portion of said each endpoint device is operable to determine the frequency of said subcarrier signal, by selecting, by means of random hopping or according to a predetermined rule of hopping, one of a plurality of frequency channels set within said available frequency band determined by said available-band determining portion of said interrogator, said frequency determining portion

26. (Previously Presented) An interrogator for transmitting an interrogating signal containing a main carrier to at least one endpoint device, the at least one endpoint device responding to the interrogator with a reflected signal that is generated by modulating the main carrier with appropriate information, said interrogator comprising:

a communication-condition detecting portion operable to detect a condition of communication of the interrogator with each endpoint device, the condition of communication being at least able to permit communication between the interrogator and the at least one endpoint device;

wherein said communication-condition detecting portion is operable to detect said condition of communication on the basis of at least one of a collision rate among the reflected signals transmitted from the at least one endpoint device, the number of occurrences of collision among the reflected signals transmitted from the at least one endpoint device per unit time, and an amount of error data contained in said reflected signal transmitted from each of the at least endpoint device;

an available-band determining portion operable to determine an available frequency band of a subcarrier signal available for said at least one endpoint device on the

basis of said condition of communication detected by said communication-condition detecting portion; and

a band-information transmitting portion operable to transmit to each endpoint device band information representative of said available frequency band of said subcarrier signal determined by said available-band determining portion.

27. (Canceled)

28. (Currently Amended) An endpoint device for responding to an interrogator after receiving an interrogating signal containing a main carrier by transmitting a reflected signal generated by modulating the main carrier with appropriate information, said endpoint device comprising:

a frequency-utilization-ratio setting portion operable to set a distribution of a frequency utilization ratio of a subcarrier signal used to modulate said main carrier, over a predetermined range of frequency of the subcarrier signal that consists of a plurality of mutually adjacent frequency channels;

a frequency determining portion operable on the basis of the distribution of the frequency utilization ratio set by said frequency-utilization-ratio setting portion to determine a frequency of said subcarrier signal by random selection within said predetermined range of frequency;

a battery cell; and

a power-source-information detecting portion operable to detect ~~the operating state~~ at least two discrete operating states of said battery cell, the at least two discrete operating state~~states~~ of the battery cell being at least able to power the endpoint device;

wherein said frequency-utilization-ratio setting portion is operable on the basis of the ~~operating state~~ one of the at least two discrete operating states of said battery cell

detected by said power-source-information detecting portion to set the distribution of the frequency utilization ratio of the subcarrier signal.

29. (Cancelled)

30. (Previously Presented) The endpoint device according to claim 28, wherein said frequency-utilization-ratio setting portion is operable to lower a center frequency of the distribution of the frequency utilization ratio of the subcarrier signal, when a supply voltage of said battery cell detected by the power-source-information detecting portion is lower than a predetermined threshold value.

31. (Previously Presented) The endpoint device according to claim 28, wherein said frequency-utilization-ratio setting portion is operable to raise a center frequency of the distribution of the frequency utilization ratio of the subcarrier signal, when a supply voltage of said battery cell detected by the power-source-information detecting portion is higher than a predetermined threshold value.

32. (Original) The endpoint device according to claim 28, wherein said frequency-utilization-ratio setting portion is operable to select one of a plurality of different frequency-utilization-ratio distribution patterns each of which represents a relationship between said plurality of mutually adjacent frequency channels and said frequency utilization ratio of the subcarrier signal, said endpoint device including a memory storing data table representative of said different frequency-utilization-ratio distribution patterns, said frequency determining portion being operable to hop the frequency of the subcarrier signal according to the selected one of said different frequency-utilization-ratio distribution pattern.

33. (Previously Presented) The endpoint device according to claim 28, wherein said frequency-utilization-ratio setting portion is operable to set the distribution of the frequency utilization ratio of the subcarrier signal so that a center frequency of said

distribution is lower when said battery cell is a primary battery cell, than when said battery cell is other than said primary battery cell.

34. (Original) The endpoint device according to claim 28, further comprising a solar cell as a power source device.

35. (Original) The endpoint device according to claim 28, wherein said frequency-utilization-ratio setting portion is operable to set the distribution of the frequency utilization ratio of the subcarrier signal, by changing at least an amount of data transmitted with said reflected signal and a time period during which said reflected signal is transmitted, each time the reflected signal having a selected one of said mutually adjacent frequency channels is transmitted.

36-38. (Canceled)

39. (Currently Amended) A communication system comprising:
an interrogator having a transmitting portion operable to transmit an interrogating signal containing a main carrier; and
a plurality of endpoint devices each operable to receive the interrogating signal and respond to the interrogator with a reflected signal that is generated by modulating the main carrier with appropriate information;
each endpoint device including:
(a) an individual-frequency-utilization-ratio setting portion operable to set a distribution of an individual frequency utilization ratio of a subcarrier signal used to modulate said main carrier over a predetermined range of frequency of the subcarrier signal, which consists of a plurality of mutually adjacent frequency channels,
(b) a frequency determining portion operable on the basis of the distribution of the individual frequency utilization ratio set by said individual-frequency-

utilization-ratio setting portion to determine a frequency of said subcarrier signal by random selection within said predetermined range of frequency,

(c) a battery cell, and

(d) a power-source-information detecting portion operable to detect supply-voltage information indicative of ~~a supply voltage~~ at least two discrete supply voltages of said battery cell, the ~~at least two discrete supply voltage~~ voltages of the battery cell being at least able to power the endpoint device;

the interrogator including:

(i) an overall-frequency-utilization-ratio determining portion operable to determine a distribution of an overall frequency utilization ratio of the reflected signal received from said plurality of endpoint devices,

(ii) an endpoint-device monitoring portion operable on the basis of said supply-voltage information received from said power-source-information detecting portion to determine one of a plurality of predetermined supply voltage ranges in which the supply voltage of said battery cell detected by said power-source-information detecting portion of said each endpoint device falls, and

(iii) a switching-information generating portion operable on the basis of the distribution of said overall frequency utilization ratio determined by said overall-frequency-utilization-ratio determining portion, and a result of determination by said endpoint-device monitoring portion, to generate switching information on the basis of which said individual-frequency-utilization-ratio determining portion of said each endpoint device sets the distribution of said individual frequency utilization ratio of the subcarrier signal;

the transmitting portion of said interrogator being operable to transmit said interrogating signal containing said main carrier and said switching information generated by said switching-information generating portion; and

the individual-frequency-utilization-ratio setting portion being operable to set the distribution of said individual frequency utilization ratio of the subcarrier signal of said each endpoint device, on the basis of said switching information generated by said switching-information generating portion and ~~said supply voltage one of the at least two discrete supply voltages~~ of said battery cell detected by said power-source-information detecting portion.

40. (Previously Presented) The communication system according to claim 39, wherein said switching-information generating portion is operable to generate the switching information for raising a center frequency of the distribution of said individual frequency utilization ratio of the subcarrier signal of said each endpoint device, when said overall-frequency-utilization-ratio determining portion determines that said overall frequency utilization ratio of said reflected signals in low frequency channels of said predetermined range of frequency of the subcarrier signal is higher than a predetermined threshold value.

41. (Original) The endpoint device according to claim 39, wherein said switching-information generating portion is operable to generate the switching information for lowering a center frequency of the distribution of said individual frequency utilization ratio of the subcarrier signal of said each endpoint device, when said overall-frequency-ratio-ratio determining portion determines that said overall frequency utilization ratio of said reflected signals in said predetermined range of frequency of the subcarrier signal is lower than a predetermined threshold value.

42. (Previously Presented) The endpoint device according to claim 39, wherein said plurality of endpoint devices include at least one first endpoint device wherein a primary battery cell is provided as said battery cell, and at least one second endpoint device wherein a secondary battery cell is provided as said battery cell, said switching-information generating portion being operable to generate the switching information that causes said individual-frequency-utilization-ratio setting portion of each of said at least one first endpoint device to

set the distribution of said individual frequency utilization ratio of the subcarrier signal so that a center frequency of the distribution of said individual frequency utilization ratio of the subcarrier signal of said each first endpoint device is lower than that of said each second endpoint device.

43–44. (Canceled)

45. (New) The endpoint device according to claim 1, said distance detecting portion detecting the distance between said interrogator and said endpoint device according to a stored data table indicative of a relationship between the intensity of the interrogating signal and the distance.

46. (New) The endpoint device according to claim 1, said distance detecting portion detecting the distance between said interrogator and said endpoint device according to an equation relating the intensity of the interrogating signal versus the distance.

47. (New) The communication system according to claim 12, said distance detecting portion detecting the distance between said interrogator and said endpoint device according a stored data table indicative of a relationship between the intensity of the modulating signal with which said reflected signal has been modulated in said endpoint devices and the distance.